May 5, 2003

NAVAL POSTGRADUATE SCHOOL

http://www.nps.navy.mil/me

This package is offered as a guide during your studies at the Mechanical Engineering Department. It is applicable to a standard 8-quarter 570 curriculum student. All other students consult with the Program Officer or Academic Associate. For questions please see the following:

CDR Stan Cunningham, Program Officer (x2033)

Prof. Fotis A. Papoulias, Academic Associate (x3381)

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Acronyms:

ABET ..... Accreditation Board for Engineering and Technology
BS ..... Bachelor of Science
BSME ..... Bachelor of Science in Mechanical Engineering
ME ..... Mechanical Engineering
MS ..... Master of Science
MSES ..... Master of Science in Engineering Science
MSME ..... Master of Science in Mechanical Engineering
MTS ..... Materials Science
TSSE ..... Total Ship Systems Engineering

Contents

1 Welcome Aboard 3
1.1 Message from the Chairman 3
1.2 Message from the Program Officer 3
2 Roadmap 5
3 Objectives 6
4 Degree Requirements 7
4.1 MS in Mechanical Engineering 7
4.2 MS in Engineering Science 7
4.3 MS in Materials Science 7
4.4 Mechanical Engineer 7
4.5 Total Ship Systems Engineering Program 7
5 What to Do and When 8
5.1 Transcript Evaluation 8
5.2 Matrix 8
5.3 BSME Equivalency Form 8
5.4 MSME Checklist 8
5.5 Thesis Approval Form 8
5.6 Graduating Student Exit Survey 8
5.7 Feedback 8
6 Thesis 9
6.1 Overview 9
6.2 Common Questions and Answers about the Thesis 11
7 For More Information 13
8 Appendices 14
8.1 Transcript Evaluation 15
8.2 Typical Course Scheduling 16
8.3 Sample Matrices 18
8.4 BSME Equivalency Form and Sample 19
8.5 MSME Checklist and Sample 20
8.6 Thesis Approval Form 21
8.7 Graduating Student Exit Survey 22

1 Welcome Aboard

1.1 Message from the Chairman

Welcome to the Department of Mechanical Engineering of Naval Postgraduate School! We are part of the Graduate School of Engineering and Applied Sciences (GSEAS). This booklet provides you with some guidelines and sample administrative forms to assist while you pursue your graduate degrees within the department. There are some milestones and the timetables that you should closely observe as you progress through your degree programs. Sample course matrices are also included for your reference. Your actual matrix may vary depending on your academic background and the actual degree you pursue. Please feel free to consult the Academic Associate and the Program Officer for further assistance. We are here to support you.

Additionally, you are required to fill out and submit the enclosed forms in accordance with the prescribed schedule. It is required that all students who are seeking the MSME degree complete both the BSME Equivalency Checklist and the MSME Checklist. Equally important is your completion of the thesis process, from selection of topics and advisor(s) to the thesis presentation. I believe the completion of your thesis is the ultimate learning experience while you study here at NPS.

Finally, I'd like to again welcome you and your family to Monterey. I wish you a memorable and enjoyable experience at NPS. Wherever you go from here, please keep in contact with us so that we may hear from you and share in your successes. Bon Voyage in your academic journey!

Young Kwon
Chair of ME Dept.

1.2 Message from the Program Officer

Welcome to Naval Postgraduate School. On behalf of the Graduate School of Engineering and Applied Sciences (GSEAS) and the entire Mechanical Engineering Department, I would like to take this opportunity to congratulate each and every one of you on your acceptance and arrival at NPS. I hope and pray that this will be both an enjoyable an educationally fruitful tour of duty. You are encouraged to seek out a balance of everything that being here has to offer. Stay focused on obtaining your advanced degree and being successful in that regard. Also remember that you need a welcome break from your work. Experience Central California and the Monterey Peninsula with family and friends whenever time will allow.

We have put together this ME Department Student Guide with your academic needs in mind. Inside you will find timelines and forms that will ensure that you successfully complete some of our necessary administrative requirements. Feel free to consult with the Academic Associate and me for additional guidance as you prepare these forms for submission. Certification of you degree completion and maintaining an accurate record

of your additional curriculum course study is incumbent on your timely submission and maintenance of these records.

Thesis research and presentation of your work to the faculty and your peers is another graduation requirement. Your choice of an area for thesis research is something not to be taken lightly. Start your search early by being attentive to current work in the department by the professors and other students. You may be able to continue existing research. Perhaps you have a personal passionate pursuit that you want to explore! Given enough time, it could be developed into an acceptable thesis proposal complete with adequate funding for you execute.

Please consider the faculty and staff as the most valuable resource in your academic endeavors. We are here for your benefit. Without you, there is no Naval Postgraduate School and the service that it provides. We will do our part to make your tour successful through a blend of quality education, career guidance and esprit de corps. I look forward to continued interaction with each and every one of you! My door is always open!

Stan Cunningham
CDR USN
Program Officer, Mechanical Engineering

2 Roadmap

The following is provided as guidance. With the exception of the first quarter all other items should be completed by the end of the indicated quarter.

Quarter	To Do
1	• Fill out (with the Program Officer) the Transcript Evaluation form and pick an initial matrix. • Fill out tentatively (with the Program Officer or Academic Associate) the BSME Equivalency form (if needed) and the MSME Checklist.
2	
3	• Start interviewing the faculty members for potential thesis topics. Make sure you read about your Thesis before you do that.
4	• Pick your Thesis Advisor, area of specialization, and schedule your electives.
5	• If you haven't picked a Thesis Advisor already, delay no longer!
6	• Fill out (with your Thesis Advisor) and submit (to the Academic Associate) the Thesis Approval Form. • Start working on your thesis.
7	• Start your thesis slots (maybe earlier). • Fill out final versions of the BSME Equivalency and MSME Checklist forms.
8	• Final revisions (if needed) of the BSME Equivalency and MSME Checklist forms. • Fill out the Graduating Student Exit Survey.
After you graduate	• Let us know when you reach an important milestone in your career, change career paths, etc.

3 Objectives

The Objectives of the Mechanical Engineering Educational Program are:

> *The overall educational objective of the Mechanical Engineering program is to support the NPS mission by producing graduates who have knowledge and technical competence, at the advanced level in Mechanical Engineering, to support national security.*

In order to achieve this goal, the specific objectives are to produce graduates who have:

- The ability to identify, formulate, and solve technical and engineering problems in Mechanical Engineering and related disciplines using the techniques, skills and tools of modern practice, including modeling and simulation. These problems may include issues of research, design, development, procurement, operation, maintenance or disposal of engineering components and systems for military applications.
- The ability to provide leadership in the specification of military requirements, in the organization and performance of research, design, testing, procurement and operation of technically advanced, militarily effective systems. The graduate must be able to interact with personnel from other services, industry, laboratories and academic institutions, and be able to understand the role that engineering and technology have in military operations, and in the broader national and global environment.
- The ability to communicate advanced technical information effectively in both oral and written form.

4 Degree Requirements

4.1 MS in Mechanical Engineering

- Completed work equivalent to BS requirements of the department. Students who do not have a BS in Mechanical Engineering with an ABET accreditation should fill out the BSME equivalency form.
- Minimum of 32 quarter hours of credits in 3000 and 4000 level courses, of which at least 12 must be at the 4000 level.
- Of the 32 quarter hours at least 24 quarter hours must be in courses offered by the Mechanical Engineering Department.
- An acceptable thesis for a minimum of 16 credits.

4.2 MS in Engineering Science

- Acceptable Academic Background.
- Minimum of 32 quarter hours of credits in 3000 and 4000 level courses, of which at least 12 must be at the 4000 level.
- Of the 32 quarter hours at least 24 quarter hours must be in courses offered by the Mechanical Engineering Department.
- An acceptable thesis for a minimum of 16 credits.

4.3 MS in Materials Science

- 32 quarter hours of graduate work in Materials Science.
- At least 16 of the 32 quarter hours must be at the 4000 level.
- In addition, at least 8 quarter hours must be earned outside of Materials Science and Engineering.

4.4 Mechanical Engineer

- Superior academic record – graduate QPR of 3.70 or better.
- A candidate may apply after completion of approximately one year of studies.
- 60 quarter hours of graduate level credits in ME and MTS.
- At least 30 of the 60 credit hours must be at the 4000 level.
- In addition, at least 12 credit hours must be earned outside the department.
- An acceptable thesis of 32 credits.

4.5 Total Ship Systems Engineering Program

- Any one of the above plus a sequence of 8 TSSE courses (including lectures and design work). For course requirements see Prof. Calvano or Prof. Papoulias.

5 What to Do and When

Fill out documents and sample forms are provided in the Appendices.

5.1 Transcript Evaluation

Fill out the attached Transcript Evaluation form as soon as you check in. See the Program Officer for help.

5.2 Matrix

Several matrices are provided as samples. Please see the Program Officer or the Academic Associate for questions/additions/deletions in your own matrix.

5.3 BSME Equivalency Form

If you are applying for the MSME degree and you do not have a BS in Mechanical Engineering from an ABET accredited University, you need to fill out this form. Do this as soon as you get your matrix. This form should be approved before your graduation. Look at the samples and read the instructions carefully. You can calculate the course quarter credit hours as the number of weekly lectures plus one-half of the weekly lab periods; e.g., a course that is listed as 3-2 has 4 credit hours.

5.4 MSME Checklist

All MSME students are required to fill out this form. Same guidelines apply as for section 4.3.

5.5 Thesis Approval Form

You need to have this form filled out at least one quarter before your first thesis slot. You need to have selected a specialization track, thesis area, electives, and a thesis advisor before you fill out this form. A good rule of thumb is during your third quarter or so. Remember that 4000 level courses are often offered only once a year.

5.6 Graduating Student Exit Survey

This is very important, please fill out this form and submit it to the chairman when you graduate.

5.7 Feedback

Let us know how you are doing in your career, especially when you get a promotion, change career paths, or reach another milestone. You can do this by e-mail or by filling out the alumni feedback form in our web site at http://www.nps.navy.mil/me/.

6 Thesis

6.1 Overview

This overview will describe the thesis, why it is very important to your graduate study, what are the steps that you will need to do and when they should or must be done, how to find an advisor, and the resources that are available to help you along the way. In the following section, questions and answers are provided for some common questions.

A thesis is a "position or proposition that a person (as a candidate for scholastic honors) advances and offers to maintain by argument." and a document containing results of original research and especially supporting a specific view.

The thesis is the most important part of your graduate education. While the course work lays the foundation by providing analytical methods and tools, it is the thesis that provides to you the opportunity to use this knowledge in a new, original and creative manner. During your thesis research you will be able to consolidate what you have already learned, and possibly extend this by further self-study, and to use this body of knowledge to attack a new problem. The thesis will hopefully be your crowning achievement of your graduate study, and will be your introduction to the community of scholars.

The first step in the thesis process is choosing an advisor and a topic. While your formal thesis slots may be in the last 2 or 3 quarters at NPS, it is very important that you have a thesis advisor and topic chosen well before this, preferably a year or so before you plan to graduate. During the time between choosing an advisor/topic and the start of your thesis slots, you should meet regularly with your advisor and spend a few hours a week reading background material and thinking about the problem.

The method for choosing your topic and advisor is completely up to you. However, you are strongly advised to talk to every faculty member in all the areas that you have any interest before making decisions. There are several questions you might want to ask yourself, before talking to the faculty. What type of work do you most enjoy? Generally, thesis research may be categorized as analytical (e.g. using a pencil and paper for mathematical modeling and derivation of solutions), computational (e.g. using finite element technique or computational fluid mechanics to find solutions), experimental (e.g. designing, building, or modifying an existing set-up to obtain new data) or some combination of the three. It is generally advisable that you take a course from a professor before you make a commitment to work for him or her. The Mechanical Engineering Faculty periodically schedule thesis opportunity presentations, where they will discuss their current research interests and the available topics. In addition, there is a ME website which contains short written descriptions for current thesis topics of ME faculty. You may talk to fellow students, who are close to graduating to discuss what they have done and how they enjoyed their experience. However, they probably will not be as good a source of what the available research topics are as the faculty members, themselves.

Finally, you may wish to review previous thesis, as well as conference and journal publications from the various faculty members.

After you find an advisor and agree on the topic, you are required to fill out a thesis approval form, which must be signed by the thesis advisor, the Academic Associate and the Chairman of the Mechanical Engineering Department.

While your advisor will help you along the way and provide broad guidance and feedback, it is the responsibility of the student to be self-motivated and to initiate all of the steps. Do not expect your advisor to provide a detailed, step-by-step, road map for you. You should be independent and think through problems first, before asking your advisor. However, that does not in any way mean you should avoid meeting with your advisor. You should meet regularly with your advisor to discuss what you have done, what issues have arisen, how you plan to solve them, and what your next steps should be.

One common problem faced by researchers, is the failure to sufficiently limit the scope of their work. Being overly broad can lead to a lack of focus and prevent any contribution from being made. It may seem to you that your advisor has asked you to solve a problem that you consider trivial and your may be inclined to broaden the scope. Stay focused on the immediate problem. If you solve the problem then by all mean go on to a larger problem. But initially, stay focus on a narrow and well-defined problem.

One way that you can help yourself is to write a short Thesis Proposal. It can be useful in helping to consolidate your understanding and focusing your future work. This may be written after you have been working on the problem for several months, have read dozens of articles and it may contain the following elements:

1. Introduction to the problem. This describes the problem and why it is important.
2. State of the art. Literature review and what is not known.
3. Objectives. Your goals for the work. What would be the desired outcome(s). Be specific. Do not say to better understand something.
4. Proposed work. Very limited and specific.

For you to make an original contribution, it generally requires that you have an understanding of what is already known, by experts in your field. Therefore, one of the primary resources on which you will depend is the NPS library and the reference staff. While the world-wide-web is becoming an increasing source of information, and you should make use of it, there are many primary sources, such as books and journals, which are not available on the web. Most of the information on the web is not archival in nature – that is, it might not exist if a certain site is closed. One of the most valuable skills you should learn during your thesis is how to obtain and process information and how to synthesize new results from that original information.

After your research is complete you will be required to write and submit a thesis document. For many of you it will be the longest document that you have written. There are several sources available to help you in writing the document, including “How to

Write a Thesis" by the Mechanical Engineering Department and several guidelines and templates available on the NPS web site.

Finally you are required to make an oral presentation of your thesis research to the faculty and students of the Mechanical Engineering Department. The presentation is approximately fifteen minutes with about a 5-minute question and answer period. A document on how to prepare and deliver this presentation is available from the Mechanical Engineering Department.

In addition to the forms and the guidelines contained in this document, NPS has extra requirements with regards to thesis processing and other forms to fill out. You will find all of this information in http://web.nps.navy.mil/~code09/research1.html

6.2 Common Questions and Answers about the Thesis

Q *What is a Thesis?*
A A thesis is an independent and original piece of research work, where the student forwards a proposition and supports the validity of this in a formal written document. The thesis is a requirement for all MSME degrees.

Q *What is a Thesis advisor?*
A A thesis advisor is a faculty member who provides guidance and advice to the student on the conduct of the research. Typically, the advisor, who is an expert in the field, supplies the problem to which you seek a solution.

Q *Who can serve as a thesis advisor?*
A The primary thesis advisor must be a "permanent" member of the NPS ME faculty. However, you may have a co-advisor or a second reader from another department, or even outside the school.

Q *When do I start the thesis?*
A Generally, you should start working on the thesis a year or more before you intend to graduate. While you thesis slots may not occur until your last 6 months, you should have chosen a thesis advisor and be hard at work long before this time.

Q *How long does the thesis require?*
A Generally, it requires almost a full year. Therefore, do not wait until the last minute before your thesis slots to find an advisor and begin your work.

Q *Can I take additional thesis slots?*
A No, not for the Master's Thesis, per se. However, it is possible to take a directed study course (ME4902), which may contain material that is related to your thesis research. In this case, you need approval from the faculty who will direct the course, Academic Associates, Program Officer, and Chairman of Mechanical Engineering. For the Engineer's Thesis, seven (7) slots are required.

Q *Can I do a joint thesis with other students?*

A No. Each student is required to submit a separate, individual thesis, which may only contains their own work, for the degree requirements to be met.

Q *Can I combine the thesis with courses and obtain joint credit?*
A No. Although you may be able to do a project for a course that is related to you thesis research.

Q *How do I select a topic/advisor?*
A That is entirely up to you. You should talk to every faculty member in the department in the area(s) in which you are interested. Generally it is best to work for someone who you are familiar, such as someone from whom you have taken a course. Since you will be required to interact your advisor on a regular basis it should be someone with whom you are comfortable.

Q *Is any funding required?*
A No, not on the part of the student. It is the responsibility of the advisor to supply any funding that will be required to complete the research.

Q *Are there additional resources available to help me write my thesis and present my results?*
A Yes. The ME department has documents available called, “How to Write a Thesis”, and “How to Make a Technical Presentation“ to help you prepare your thesis and presentation.

7 For More Information

For more information please refer to the Department's web site at http://www.nps.navy.mil/me/ or see the Program Officer or the Academic Associate.

For more information on TSSE and past student projects refer to the TSSE web site at http://www.nps.navy.mil/tsse/ or see Prof. Calvano or Prof. Papoulias.

8 Appendices

The following appendices are provided:

1. Transcript Evaluation Form
2. Typical Course Scheduling
3. Sample Matrices
4. BSME Equivalency Form and Sample
5. MSME Checklist Form and Sample
6. Thesis Approval Form
7. Graduating Student Exit Survey

8.1 Transcript Evaluation

Fill out the Transcript Evaluation form as soon as you check in. You will find this form online at http://web.nps.navy.mil/~me/files/TranscriptEvaluation.doc
See the Program Officer and the Academic Associate for help.

8.2 Typical Course Scheduling

Number	Title		Fall	Win	Spr	Sum
ME0810	Thesis Research	0/8	X	X	X	X
ME0952	Special Topics in Mechanical Engineering	1/0	X	X	X	X
ME1000	Preparation for PE Registration	3/0	0	0	0	X
ME2101	Engineering Thermodynamics	4/2	X	0	X	0
ME2201	Introduction to Fluid Mechanics	3/2	X	0	X	0
ME2503	Engineering Statics and Dynamics	5/0	X	0	X	0
ME2601	Mechanics of Solids I	4/1	0	X	0	X
ME2801	Introduction to Eng. System Dynamics	3/2	X	0	X	0
ME3150	Heat Transfer	4/1	0	X	0	X
ME3201	Applied Fluid Mechanics	4/1	0	X	0	X
ME3240	Marine Power and Propulsion	4/2	0	X	0	X
ME3450	Computational Methods in Mech. Eng.	3/2	X	0	X	0
ME3521	Mechanical Vibration	3/2	0	X	0	X
ME3611	Mechanics of Solids II	4/0	X	0	X	0
ME3711	Design Of Machine Elements	4/1	X	0	X	0
ME3712	Capstone Design Project	1/6	0	X	0	X
ME3801	Classical Control of Naval Eng. Systems	3/2	0	X	0	X
ME4160	Applications of Heat Transfer	4/0	0	0	0	0
ME4161	Conduction Heat Transfer	4/0	0	X	0	0
ME4162	Convection Heat Transfer	4/0	X	0	0	0
ME4163	Radiation Heat Transfer	4/0	0	0	X	0
ME4202	Compressible Flow	3/0	0	0	0	0
ME4211	Applied Hydrodynamics	4/0	0	0	0	0
ME4220	Viscous Flow	4/0	0	0	0	X
ME4240	Advanced Topics in Fluid Dynamics	4/0	0	X	0	0
ME4300	Weaponeering	3/2	0	X	0	0
ME4420	Marine Gas Turbines	4/0	X	0	0	0
ME4522	FEM in Structural Dynamics	4/0	X	0	0	0
ME4525	Naval Ship Shock Design and Analysis	4/0	0	0	0	X
ME4550	Random Vibrations and Spectral Analysis	3/2	0	X	0	0
ME4612	Advanced Mechanics of Solids	4/0	0	X	0	0
ME4613	Finite Element Methods	4/0	0	0	X	0
ME4620	Theory of Continuous Media	4/0	0	0	0	0
ME4731	Engineering Design Optimization	4/0	0	0	0	X
ME4811	Multivariable Control of Ship Systems	3/2	X	0	0	0
ME4812	Fluid Power Control	3/2	0	0	0	0

ME4821	Advanced Dynamics	3/2	0	0	X	0
Number	**Title**		**Fall**	**Win**	**Spr**	**Sum**
ME4823	Dynamics of Marine Vehicles	4/0	0	X	0	0
ME4825	Marine Propulsion Control	3/2	0	0	0	0
ME4902	Advanced Study in ME	V/0	X	X	X	X
MS2201	Intro. to Materials Science and Eng.	3/2	0	X	0	X
MS3202	Prop., Perf. & Failure of Eng. Materials	3/2	X	0	X	0
MS3214	Interm. Materials Science and Engineering	4/0	0	0	0	0
MS3304	Corrosion and Marine Env. Deterioration	3/2	0	0	X	0
MS3606	Intro. to Welding and Joining Metallurgy	3/2	X	0	0	0
MS4215	Phase Transformations	3/2	0	0	0	0
MS4312	Characterization of Advanced Materials	3/2	0	0	X	0
MS4811	Mech. Behavior of Engineering Materials	4/0	X	0	0	0
MS4822	The Eng. and Sci. of Composite Materials	4/0	0	X	0	0
MS4902	Special Topics in Materials Science	V/0	X	X	X	X
TS3000	Electrical Power Engineering	3/2	X	0	0	0
TS3001	Fund. Prin. of Naval Architecture	3/2	0	X	0	X
TS3002	Prin. of Ship Design and Case Studies	3/2	0	X	0	0
TS3003	Naval Combat System Elements	3/2	0	X	0	0
TS4000	Naval Combat System Engineering	3/2	0	0	X	0
TS4001	Integration of Naval Engineering Systems	3/2	0	0	X	0
TS4002	Ship Design Integration	2/4	0	0	0	X
TS4003	Total Ship Systems Engineering	2/4	X	0	0	0
EC1010	Introduction to MATLAB	1/1	X	X	X	X
EO2102	Intro. to Circuit and Power Systems	4/2	0	X	0	X
OS3104	Statistics for Science and Engineering	4/0	X	X	X	X
AA3802	Aeronautical Measurement Techniques	3/2	0	X	0	X
AA4507	Comp. Fluid Dynamics and Heat Transfer	3/2	0	X	0	0
MA1042	Matrix Algebra	2/0	0	X	0	X
MA1118	Multi-Variable Calculus	5/2	X	X	X	X
MA2139	Intro. to Diff. Equs. and Vector Calculus	5/0	X	X	X	X
MA3132	Partial Diff. Equs. and Integral Transforms	4/0	X	X	X	X
MA3232	Numerical Analysis	4/1	X	X	X	X
NW3230	Strategy and Policy: The Am. Experience	4/2	X	X	X	X

8.3 Sample Matrices

You will find several sample matrices online at http://web.nps.navy.mil/~me/info.htm
Note that those are provided for general guidance only. Please see the Program Officer or the Academic Associate for questions/additions/deletions in your own matrix.

8.4 BSME Equivalency Form and Sample

If you are applying for the MSME degree and you do not have a BS in Mechanical Engineering from an ABET accredited University, you need to fill out this form. You will find the form along with a sample online at http://web.nps.navy.mil/~me/info.htm Do this as soon as you get your matrix. You will be reminded to fill this out one quarter before you graduate. Look at the samples and read the instructions carefully. You can calculate the course quarter credit hours as the number of weekly lectures plus one-half of the weekly lab periods; e.g., a course that is listed as 3-2 has 4 credit hours.

8.5 MSME Checklist and Sample

All MSME students are required to fill out this form. You will find the form along with a sample online at http://web.nps.navy.mil/~me/info.htm Read the guidelines of section 4.3 first.

8.6 Thesis Approval Form

You need to have this form filled out at least one quarter before your first thesis slot. You will find the form online at http://web.nps.navy.mil/~me/info.htm You need to have selected a specialization track, thesis area, electives, and a thesis advisor before you fill out this form. A good rule of thumb is during your third quarter or so. Remember that 4000 level courses are often offered only once a year.

8.7 Graduating Student Exit Survey

You will have to fill this form out when you graduate. The form is located online at http://web.nps.navy.mil/~me/info.htm Also remember to keep us informed of your progress during your career. You can do this by e-mail or by filling out the alumni feedback form in our web site at http://www.nps.navy.mil/me/.